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ABSTRACT

This study examined the effects of Knowledge of Results, Knowledge of Performance and a combination of the two in the learning of a novel motor task by totally blind subjects. Thirty-three totally blind subjects tossed a velcro ball dart at a target while receiving augmented verbal information feedback. Each subject completed three learning sessions and one retention session, each consisting of 30 trials. During learning sessions subjects received one of three forms of verbal information feedback. Across each of the sessions, the combination of Knowledge of Results and Knowledge of Performance generated a higher performance mean. The increase in performance mean across learning sessions supports the position that totally blind subjects are able to use augmented verbal information feedback to improve the performance of their gross motor skills. (Author/JD)

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The Effects of Augmented Verbal Information Feedback in the Motor Skill Learning of Totally Blind Subjects Fourteen to Twenty-one Years of Age

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THE EFFECTS OF AUGMENTED VERBAL INFORMATION FEEDBACK IN THE MOTOR SKILL LEARNING OF TOTALLY BLIND SUBJECTS FOURTEEN TO TWENTY-ONE YEARS OF AGE. Daniel P. Joseph, University of Wyoming.

The intent of the study was to examine the effects of Knowledge of Results, Knowledge of Performance and a combination of Knowledge of Results and Knowledge of Performance in the learning of a novel motor task by totally blind subjects. Thirty-three totally blind subjects tossed a velcro ball dart at a 40" x 40" target while receiving augmented verbal information feedback. Each subject completed three learning sessions (separated by a two-minute rest) and one retention session (24 hours later), each consisting of 30 trials. During learning sessions, subjects received one of three forms of verbal information feedback. The combination of Knowledge of Results and Knowledge of Performance yielded the highest mean (5.19) followed by Knowledge of Performance (4.81), and Knowledge of Results (4.31). The difference between these treatment means, however, was not significant ($p=.3735$). Performance was also analyzed by learning session. The mean was highest in the third learning session (5.23), followed by the second learning session (5.00), and the first (4.66). The mean of the retention session was the lowest of the four sessions (4.30). Examination of ANOVA procedures indicate that significant differences ($p=.0005$) existed between sessions. In observing the treatment effects across learning sessions, an increase in performance was noted. ANOVA procedures, however, indicate that a treatment by sessions interaction did not exist ($p=.9700$), rather that a consistent pattern was present. Across each of the four sessions, the combination of Knowledge of Results and Knowledge of Performance generated a higher performance mean. Similarly the Knowledge of Performance and Knowledge of Results treatments generated lower performance means across each of the four sessions. The increase in performance mean across learning sessions supports the position that totally blind subjects are able to use augmented verbal information feedback to improve the performance of their gross motor skills. The difference between the effects of Knowledge of Results, Knowledge of Performance, and a combination of Knowledge of Results and Knowledge of Performance, however, is apparent but not statistically significant.

The role of feedback and Knowledge of Results (KR) as it relates to learning is strongly supported by research (Schmidt, 1980). Studies of information feedback (IF) or Knowledge of Results (KR) show it to be the strongest, most important variable controlling performance and learning (Irion, 1966; Bilodeau & Bilodeau, 1961). Several studies have shown that there is no improvement without KR, progressive improvement with KR, and deterioration of performance after its withdrawal (Bilodeau & Bilodeau, 1961).

According to Marteniuk (1976), "a well established fact is that if a learner is not told how well or poorly his movement matched the goal or desired outcome, learning will not occur" (p. 180). Information feedback serves at least the three following empirical properties generalized from the issues of reward research. Feedback has been thought to strengthen responses; sustain performance; and to eliminate previously established responses (Bilodeau, 1966; Bilodeau & Bilodeau, 1961; Robb, 1966).

Knowledge of Results (KR) is viewed as a source of error information used by the subject in problem-solving. As such, "a key assumption is that the subject actively operates upon KR during motor learning and uses the information it provides to develop a plan and/or to evaluate the various hypotheses he generates relating to the nature of the correct response" (Schendel & Newell, 1976, p. 251).

The role of KR has been examined with handicapped populations. Two studies examined the effect of KR in the learning of the pursuit rotary task with mentally retarded subjects (Baumeister, Hawkins, & Holland, 1966; and Horgan, 1980). Horgan (1980) found auditory feedback associated with correct responses to be most effective for his mildly retarded subjects. Baumeister, et al. (1966) found their mentally retarded and non-handicapped subjects to "benefit equally from supplementary knowledge of results" (p. 42). Loovis and Ziegler (n.d.) examined the effects of verbal augmented Information Feedback in the form of KR, Knowledge of Performance (KP), and a combination of KR and KP in the learning of a shuffle board task by a congenitally blind adult female.

Research related to the effects of Information Feedback have traditionally used the learning of linear positioning tasks by blindfolded non-handicapped subjects. In the present study, the use of totally blind subjects negates the confounding influence of vision in non-handicapped subjects who have had their main source of information removed via blindfolding. Secondly, this study attempts to extend the existing body of literature into gross motor activities such as dart throwing.

Humans are seen as information processing systems. As such, KR is information that is actively processed to serve a directive function for subsequent responses (Adams, 1978). KR focuses on the outcome of a task performance. "It would seem far more effective to provide information about the patterns of movement the person made (KP) rather than just the outcome in the environment (KR)" (Schmidt, 1982, p. 533). Research related to the effects of KP rather than KR is rarely found. The present study examines the effects of KR and KP in the motor skill learning of totally blind subjects.

METHODS AND PROCEDURES

The present study examines the effect of augmented verbal information feedback in the learning of a novel velcro dart-throwing task by totally blind subjects. To eliminate interference with the subject's ability to successfully perform the required task, participants of the study were identified by school personnel to be totally blind students free from mental or physical handicaps. Thirty-three totally blind students from the Ohio State School for the Blind (Columbus n=13), Kentucky School for the Blind (Louisville n=4), and the Indiana School for the Blind (Indianapolis n=16) met the requirements for participation in the investigation. Subjects from each school were randomly assigned to one of three verbal IF treatment groups.

The task was to throw a velcro dart from a stationary position to a target set 7' 9¼" (2.37 meters) away. The distance of 7' 9¼" (2.37 meters) is the official distance for competitive dart throwing. The dart was offered to the subject with the instruction to throw when ready. Verbal information feedback was offered immediately (within 5 seconds) after execution, with a subsequent trial performed after a self-paced post-KR interval.

The target for the velcro dart throwing task was set on a cloth background. The cloth was selected for use due to its fabric nature and response to velcro fasteners. The cloth was a 40" x 40" crocket material separated into six concentric rings. The scoring regions were separated by raised lines. The regions were valued as 10 (4" diameter); 9 (8" diameter); 7 (16" diameter); 5 (24" diameter); 3 (32" diameter); and 1 point (40" diameter). The design of this target was consistent with targets of the Federation of International Target Archery (F.I.T.A.). An auditory cuing device was positioned behind the target center to provide a directional stimulus.

A velcro dart was tossed at the target in the course of the investigation. The dart was a 1.5 inch hollow plastic ball with five 1" x $\frac{1}{2}$" velcro strips located around its circumference. The velcro dart is available commercially.

The subject groups received Knowledge of Results (KR), Knowledge of Performance (KP), or a combination of KR and KP during the treatment phase. Each treatment group received an information feedback treatment in three 30 trial sessions separated by a two minute rest period. A retention session was conducted 24 hours later. During the retention session, subjects in all treatment groups performed the velco-dart throwing task without the benefit of verbal information feedback. The resulting target scores were examined to determine the effect of verbal information feedback on skill acquisition and retention.

Each subject's participation required two days. On their initial visit to the data collection site, the subjects participated in an Orientation Format. A similar orientation format was also followed prior to the retention sessions trials. The session began with the experimenter explaining the type of verbal information feedback to be provided. Verbal information feedback was provided in three treatment conditions:

Treatment A: Knowledge of Results (KR). Following each trial, the subject was told: a. your toss missed the target to the right; b. your toss missed the target to the left; c. your toss missed the target high; d. your toss missed the target low; e. your toss missed the target high, right; f. your toss missed the target high, left; g. your toss missed the target low, right; h. your toss missed the target low, left; i. your toss hit the target to the right of the center; j. your toss hit the target to the left of the center; k. your toss hit the target above the center; l. your toss hit the target below the center; m. your toss hit the target above the right of the center; n. your toss hit the target above the left of the center; o. your toss

hit the target below and right of the center; or, q. your toss hit the target center.

Treatment B: Knowledge of Performance (KP). Following each trial, the subject was provided with verbal information feedback relating to his/her motor performance. KP information feedback focused on a single (most detrimental) aspect of the task performance.

According to Jensen and Schultz (1970), accuracy results when "superfluous" (noncontributing) movements are reduced to a minimum" (p. 355). This may be accomplished "by identifying noncontributing motions and purposely eliminating them" (Jensen & Schultz, 1970, p. 356). In this regard, KP focused primarily on the position and movement of the throwing arm. Other verbal KP IF focused on the position and movement of the shoulders, trunk, feet, and body. Examples of the KP treatment condition include: a. you released the dart too soon; b. you released the dart too late; c. you released the dart off to the (right/left) side, you need to point your hand to the sound; d. you are moving your (body part) too much, this motion does not help your toss, try to move as little as possible; or e. perfect toss.

Treatment C: KP + General KR. Following each trial, the subject received verbal IF as described in both Treatment A and Treatment B above.

The dependent variable, recorded as indicative of motor skill learning, was the score received by throwing the dart at the target. One practice trial was allowed at the start of each session. The score of this trial was not used for analysis because it was executed without benefit of a prior information feedback statement.

Interrater reliability was determined between two doctoral students in physical education and the examiner. The reliability was determined by analysis

of score agreement over agreement plus disagreement. The coefficient of agreement over twenty trials was 98.33 percent. One score disagreement was noted in sixty reliability comparisons when a trial toss landed on a line separating two scoring regions.

RESULTS AND DISCUSSION

Statistical analysis was completed through the use of Analysis of Variance for repeated measures for performance scores yielding a range from zero to ten with an overall mean of 4.80.

Analysis of Results of Treatments by Session

As noted earlier, each subject participated in three (thirty trial) retention session. The mean standard deviation for each session are shown in Table 1. The mean was highest in the third learning session (5.23), followed by the second learning session (5.00), and the first learning session (4.665). The mean of the retention session (4.30) was the lowest of the four sessions. Examinations of ANOVA procedures indicate that significant differences ($p=.0005$) existed between sessions.

Post hoc examinations of these four session means with use of Fisher's I.S.D. method identified significant differences to exist ($p \neq .05$). The performance mean of learning session III was found to be significantly greater than that of learning session I. Similarly, the mean performance of the retention session was significantly lower than the mean performance of each of the learning session II was not significantly different from that of learning session III when observed in post hoc examination.

In observing the effect of IF treatments across learning sessions, an increase in performance was noted. ANOVA procedures, however, indicated that a treatment by session interaction did not exist ($p = .9700$), rather that a consistent pattern was present. Across each of the four sessions, the combination of KR + KP treatment generated a higher performance means across each

of the four sessions. The mean and standard deviation of each treatment by session are shown in Table 1.

Across each treatment condition, a performance drop is noted from learning session III to the retention measure taken 24 hours later. Without the benefit of verbal IF, the performance mean of the KR + KP treatment group dropped 1.05 (82%), KP dropped 0.67 (87%), and KR dropped 1.08 (78%). Although statistically significant differences cannot be claimed, the KR treatment generated a greater performance increase as well as less loss of performance without the benefit of verbal IF during the retention session taken 24 hours later.

As noted earlier, IF has been found to be vital to the improvement of performance and learning. The increase of performance mean across the learning sessions support this position. In the presence of augmented verbal IF, totally blind school-aged subjects improved their performance of the velcro-dart throwing task. Similarly, in the absence of augmented verbal IF, the performance mean dropped significantly in the retention session taken 24 hours later. This finding is consistent with research indicating that the peformance of a discrete task drops progressively after twenty minutes (Neuman & Ammons, 1957). Performance during the retention sessions may also have been affected by a lesser motivation of the totally blind subject to perform well associated with the removal of IF.

Insert Table 1 About Here

Analysis of Results by Treatments

Three forms of verbal IF were provided during the learning sessions. Knowledge of Results (KR), Knowledge of Performance (KP), and a combination of KR + KP yielded the highest treatment mean (5.19), followed by KP (4.81) and KR (4.31). Analysis by ANOVA procedures, however, indicate that the difference between these treatment means were not significant (p=.3735). The ANOVA summary table may be found in Table 2.

Significant differences were not found to exist between the effect of the three verbal information feedback treatments. In discussion of this finding, let us first review the findings of pertinent related literature.

Wallace and Hagler (1979) compared the effects of Social Reinforcement to Knowledge of Performance in the learning of the basketball foul shot with the non-dominant hand. In this study, Wallace and Hagler (1979) provided both treatment groups with KR by allowing the subjects to visually observe the results of each shot. The group receiving KP was found to show superior performance.

Loovis and Ziegler (n.d.) examined the effects of augmented verbal IF in the learning of a shuffle board task by one congenitally blind adult female. IF in the form of KR, KP, and a combination of KR + KP was presented in a multi-element single subject design. Loovis and Ziegler (n.d.) reported all IF treatments to be "effective in promoting skill acquisition, but that each was differentially effective during the learning curve" (p. 7).

Both Wallace and Hagler (1979) and Loovis and Ziegler (n.d.) noted the need for KP "at least initially" (Loovis & Ziegler, n.d., p. 10) to "develop proper mechanics" (Wallace & Hagler, 1979, p. 269) and "shape appropriate skill topography and execution" (Loovis & Ziegler, n.d., p. 10). These studies, however, differ in their use of KR. Wallace and Hagle (1979) allowed their subjects to gather their own KR visually. In contrast, the totally blind subject in Loovis and Ziegler's (n.d.) study made use of augmented verbal IF. In final comparison, we must focus on the learning processes of visually impaired and non-handicapped populations.

In examining the need of the visually impaired, Buell (1982) noted chat "the more loss of vision a student has, the more he must depend upon his other senses to gain information" (p.ix.). Buell (1982) further notes that a blind

child "depends primarily upon his tactual and auditory senses to obtain information about himself and his environment" (p. 54). In this respect the teacher of the visually impaired "should give detailed auditory instructions which are in concrete terms within the individual's realm of experience and not based on visual cues" (Buell, 1982, p. 54). As such, the role of supplemental information feedback is magnified.

The visually impaired must develop great sensitivity to their available senses to obtain information about their environment. As such, their ability to use the auditory and kinesthetic sense is highly refined. We may speculate, therefore, that as a result of their refined sense, the totally blind subjects were able to effectively use KR, KP, and a combination of KR + KP to adapt their throwing pattern to improve their performance. In this respect, the IF treatment conditions may not be seen as separate and distinct to totally blind subjects.

On one hand, this finding may indicate a methodological problem where the IF treatments were not presented to be distinct and separate. On the other hand, this finding may indicate a difference in the way in which totally blind subjects use augmented verbal IF to learn.

In light of the results generated, and within the limitations of this study, the following conclusions are rendered:

1. Totally blind subjects are able to use augmented verbal information feedback to improve the performance of their gross motor skills.
2. The difference between the effects of KR, KP, and the combination of KR + KP treatments in the gross motor skill learning of the totally blind is apparent but not statistically significant.

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TABLE 1

Mean and Standard Deviation of Treatments by Session

TREATMENT	LEARNING SESSION I	LEARNING SESSION II	LEARNING SESSION III	RETENTION SESSION	OVERALL
KR	4.05	4.54	4.87	3.79	4.31
n=10	1.75	1.53	1.29	1.22	
KP	4.76	5.07	5.04	4.37	4.81
n=11	1.16	1.39	1.36	1.41	
KR + KP	5.08	5.32	5.71	4.66	5.19
n=12	1.93	2.03	1.77	2.23	
OVERALL	4.66	5.00	5.23	4.30	4.80
n=33					

TABLE 2

ANOVA of Performance Score by Treatment and Session

Source	df	SS	MS	F	p F
Treatment	2	16.8897	8.4448	1.02	.3735
Error a	30	248.8608	8.2954		
Session	3	16.2463	5.4154	6.43	.0005
Interaction	6	1.1040	.1840	.22	.9700
Error b	90	75.8016	.8422		